

Calorie Slashing and Overexertion Can Stress the Immune System

W eek after week of little sleep and extreme overexertion can put even a young, physically fit body at higher risk of infection when that body isn't getting enough calories to replace those it burns each day.

That's what ARS' Tim R. Kramer found when the U.S. Army asked him to look into why men in a Ranger training class at Fort Benning, Georgia, were developing infections uncharacteristic of healthy, young adults.

"The men are deliberately sleep deprived and food deprived, to see who can set aside personal needs to complete a mission," explains Major Karl E. Friedl, an Army physiologist at Fort Detrick, Maryland. "But medical researchers were called in after a class was decimated by strep pneumonia," he explains.

So Kramer tested blood samples of men in two Ranger training classes and one class of aspirants to the Special Forces as well as a fourth group of new inductees—all women—during basic training. He was looking for differences in immune response under different exercise and diet regimes.

All three groups of men burned about 4,000 calories daily during their rigorous training, but their intakes differed markedly. So did the ability of their T-cells to divide and conquer invading pathogens, Kramer says. T-cells are the player coaches of the immune system; they disable pathogens themselves and signal for help when it's needed.

Men in the first class of Rangers tested had consumed 1,300 fewer calories than they burned each day, and they had a 50- to 60-percent drop in T-cell response, says Kramer. So the next class was given more food but was still 900 calories shy of what they burned. That helped

somewhat. This group had a 30-percent drop in T-cell response.

Special Forces aspirants in training at Fort Bragg, North Carolina, got even more to eat—just 250 calories less than they burned—and had even less of a drop in T-cell response—20 percent.

"The reduction in T-cell function due to hard physical stress seems to be worsened with calorie deficiency," says Kramer. "The bigger the deficit, the more it compromised immune response."

On the other hand, T-cell response improved 150 to 200 percent in the women recruits during basic training at Fort Jackson, South Carolina. They had gotten all the calories they needed, along with the military regimen. A little out of shape to begin with, he says, the recruits got daily exercise, regular meals, and no cigarettes.

Kramer measured an indicator of physical stress—interleukin 6 (IL-6)—in all four groups. He says the women began with typical levels; the men began with very high levels indicative of their high level of physical activity. "It increased somewhat in the men and then started downhill. Their bodies were saying, 'We can't keep up with the physical demands.' Such demands would also tend to reduce their defense against disease."

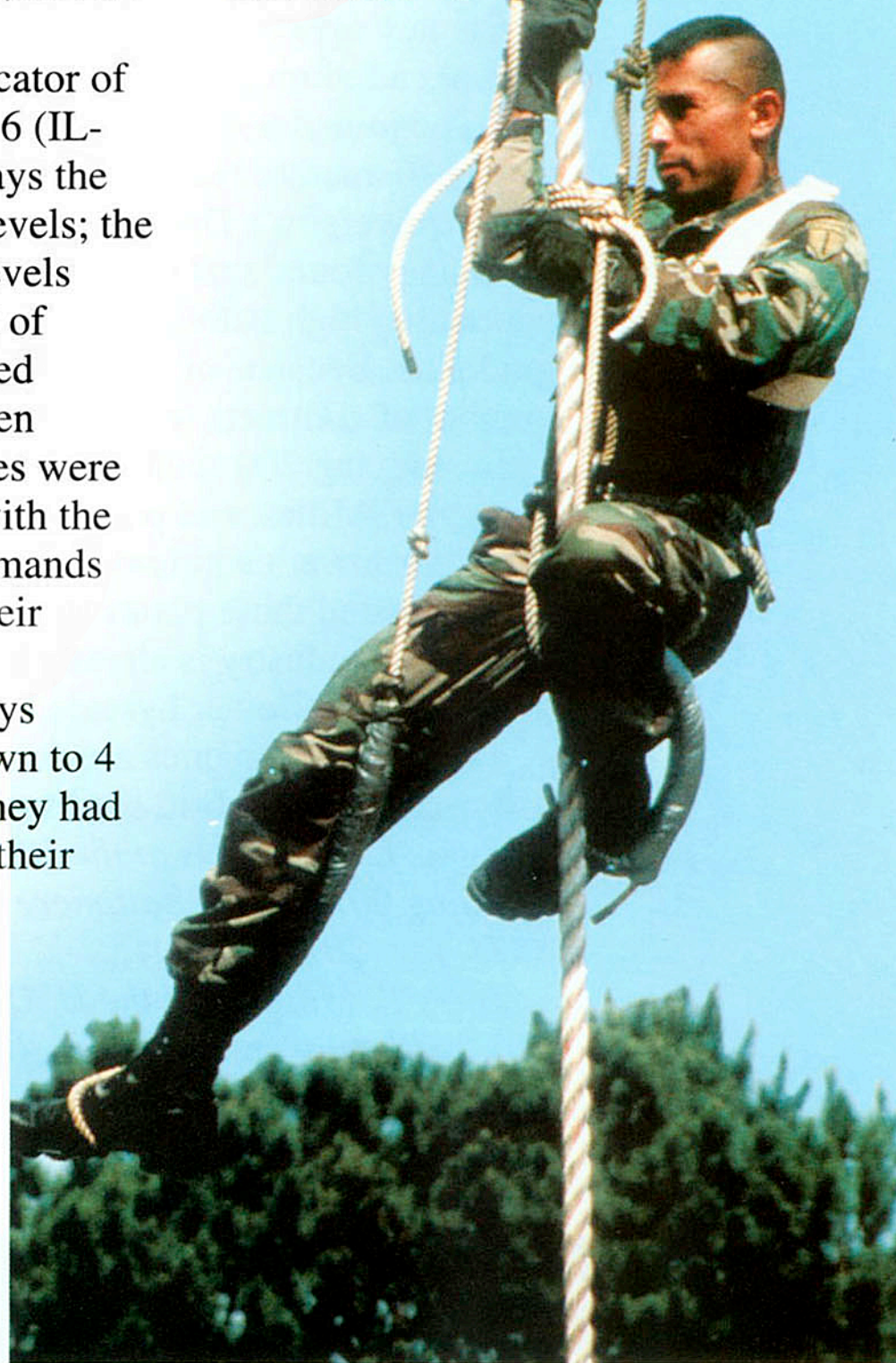
By the end of 8 weeks, says Friedl, the Rangers were down to 4 or 5 percent body fat. And they had lost an average 7 percent of their lean mass—mostly muscle.

A month later, he continues, "everything was back to normal, except they had put on excess body fat—a typical reaction to extreme calorie deficits. And that was back to normal after 6 months. There is no evidence of

any lasting health problems."

So, as the old axiom says, too much of a good thing—in this case, cutting calories and increasing exercise—can hurt you. At least, temporarily.—By **Judy McBride**, ARS.

Tim R. Kramer is at the USDA-ARS Beltsville Human Nutrition Research Center, Bldg. 307, 10300 Baltimore Ave., Beltsville, MD 20705-2350; phone (301) 504-8459, fax (301) 504-9062. ♦



U.S. ARMY PHOTO